National Digital Forecast Database (NDFD)
Convective Outlook Hazard Probability Elements
NWS Product Definition Document (PDD)
February 27, 2007

Part 1 - Mission Connection

a. Product Description: The National Digital Forecast Database (NDFD) contains a seamless mosaic of digital weather forecasts from National Weather Service (NWS) field offices and the National Centers for Environmental Prediction (NCEP). The Storm Prediction Center (SPC) is the NWS' center of expertise for forecasting convection, especially for life-threatening and economically-disruptive weather events such as tornadoes, large hail, and damaging winds.

As of February 27, 2007, the following Convective Outlook Hazard Probability elements prepared by the SPC are now available in the NDFD in experimental status:

- Categorical Convective Outlook for today (Day 1), tomorrow (Day 2), and the day following (Day 3)
- Probability of Tornadoes (Day 1)
- Probability of Hail (Day 1)
- Probability of Damaging Thunderstorm Winds (Day 1)
- Probability of Extreme Tornadoes (Day 1)
- Probability of Extreme Hail (Day 1)
- Probability of Extreme Thunderstorm Winds (Day 1)
- Total Probability of Severe Thunderstorms (Day 2 and Day 3)
- Total Probability of Extreme Severe Thunderstorms (Day 2 and Day 3)

All of these elements are currently only available for the contiguous U.S. (CONUS) and the 16 pre-defined NDFD CONUS subsectors (see http://www.weather.gov/ndfd/coverage.htm).

The Convective Outlook Hazard Probability elements are issued for a convective day from 1200 Coordinated Universal Time (UTC) to 1200 UTC. Day 1 Outlooks are valid from 1200 UTC on Day 1 (or, if issued after 1200 UTC -- from the issuance time) to 1200 UTC on Day 2. The Day 2 products are valid from 1200 UTC on Day 2 to 1200 UTC on Day 3. The Day 3 products are valid from 1200 UTC on Day 3 to 1200 UTC on Day 4.

The Categorical Convective Outlook elements specify the perceived level of threat via the descriptive wording: Slight, Moderate, and High Risk. However, these outlooks, do not display the forecaster's expectations of the individual severe weather hazards (large hail, damaging winds, and tornadoes).

The individual probabilistic elements further express forecaster uncertainty of the individual severe weather hazards through the use of probabilities (i.e., percent likelihood of occurrence). In the Day 1 period, forecaster expectations of large hail, damaging winds, and

tornadoes are explicitly conveyed in separate forecasts. By producing forecasts of each hazard individually, users who are sensitive to one particular threat (e.g., car dealers and large hail) can make more informed decisions.

b. Purpose: In support of the mission described in the ***National Weather Service Strategic Plan for FY2003 - FY 2008***, the NDFD is a "...national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community." The NDFD is the primary means by which digital information will be made available to customers and partners. As part of this digital database, Convective Hazard Outlook Probability elements are available in response to growing user needs for planning purposes and critical safety decisions. Future digital datasets will continue to be developed in accordance with growing user needs.

c. Audience: The audience for the Convective Hazard Outlook Probability elements includes large volume users of forecast information, emergency managers, the media, utility companies, the aviation industry, storm spotters, government agencies (including NWS field offices), academia, agricultural interests, and many other groups. They are also for anyone who wishes to decode and explore various potential applications of the NWS Convective Hazard Outlook Probability data; or simply view, post, or distribute the graphic images.

d. Presentation Format: As with all NDFD elements, these elements are available in Gridded Binary Data Edition 2 (GRIB2) via file transfer protocol (ftp), eXtensible Markup Language (XML), and web browser. The Convective Hazard Outlook Probability elements are only available for the CONUS and for the 16 pre-defined NDFD CONUS subsectors (see http://www.weather.gov/ndfd/coverage.htm).

1. GRIB2 format at 5 km horizontal grid spacing, via file transfer protocol (ftp): The GRIB2 files can be decoded and converted to other formats, such as shapefiles, netCDF files, etc. A tutorial to download NDFD elements, decode them and generate images is posted online at:

   http://www.weather.gov/ndfd/gis/ndfd_tutorial.pdf

   The GRIB2 files are available from the NWS ftp server (see http://www.weather.gov/ndfd/anonymous_ftp.htm) for the CONUS and/or for the 16 pre-defined NDFD CONUS subsectors (see http://www.weather.gov/ndfd/coverage.htm). A user-defined GRIB2 access method is also available. That service allows the user to input latitude/longitude points for two corners and select a single weather element. The resulting GRIB2 message is built "on-the-fly" and downloaded by the user. For more information about User Defined GRIB2 access, please refer to the Service Description Document at:

   http://products.weather.gov/PDD/User_Defined_Grib2.pdf

2. Extensible Markup language (XML): Users can request NDFD elements over the Internet using the NDFD XML Simple Object Access Protocol (SOAP) server. The response to the user request is returned in XML format. For more information, please refer to the NDFD XML Service Description Document online at:

http://products.weather.gov/PDD/Extensible_Markup_Language.pdf

3. Online NDFD graphics: Convective Hazard Outlook Probability images may be accessed from the NWS homepage (www.weather.gov) by clicking on the "Graphical Forecasts" tab, or directly at the following URL:

   http://weather.gov/forecasts/graphical/sectors/index.php

To access these and other NDFD elements, or for further technical information (e.g., temporal and spatial resolutions, forecast projections, and geographic coverage), please visit the following URL:

http://www.weather.gov/ndfd/technical.htm

e. Feedback Method: User feedback is important in our effort to improve the quality and usefulness of products and services. Please submit your comments on these experimental elements by completing one of the brief experimental product surveys shown below. Comments and feedback on the Convective Hazard Outlook Probability elements will be accepted through June 29, 2007.

GRIB2 NDFD users:
http://www.weather.gov/survey/nws-survey.php?code=ndfd-grids

Users of NDFD XML SOAP service:
http://www.weather.gov/survey/nws-survey.php?code=xmlsoap

Users of NDFD online graphics:
http://www.weather.gov/survey/nws-survey.php?code=gfp

Technical questions regarding the Convective Hazard Outlook Probability elements may be addressed to:

http://www.spc.noaa.gov/misc/feedback.html.

For general questions regarding the NDFD, please e-mail:

nws.ndfd@noaa.gov

Part II - Technical Description

a. Format and Science:

Day 1

The most specific Convective Hazard Outlooks are those issued during the Day 1 period (as described in Part I, section a, Product Description, above). During this period, the SPC produces probabilistic outlooks for each primary severe weather hazard (tornadoes, damaging wind, and large hail) separately. By producing separate forecasts for each hazard, the user is given substantially more information upon which to make decisions than in the categorical (slight, moderate, high) outlook. In addition to the probabilities for separate types of severe weather occurring, a 10% or greater chance of extreme severe weather is also included. Extreme severe weather is defined as tornadoes rated Enhanced Fujita Scale Category 2 (EF2) or greater (see http://www.spc.noaa.gov/efscale/ for more information on the EF Scale); damaging winds with speeds greater than 65 knots; or hail 2 inches or greater in diameter. If the forecaster believes there is less than a 10% chance of extreme severe weather occurring in the outlook area, the area will not be included in the forecast.

Day 2 and Day 3

Probabilistic Hazard Outlooks are also issued for the Day 2 and Day 3 periods (as described in Part I, section a, Product Description, above). Since many of the specific details of severe weather forecasting can only be determined hours ahead of time, rather than several days, the severe weather probabilities for the Day 2 and Day 3 outlooks represent the probability of any severe weather hazard (large hail, damaging wind, or tornadoes) occurring (rather than producing individual forecasts for each hazard). Areas where there is a 10% or greater probability of extreme severe weather events (again, defined as 2 inch diameter or larger hail, 65 knot or stronger winds, and EF2 or stronger tornadoes) are also included, when forecast.

Categorical Outlooks

There are five risk categories in the categorical outlooks:

1. No Significant Thunderstorm, represented by the grid value of zero (0). There is less than a 10% probability of thunderstorms during the valid period in this area.

2. General Thunderstorms, represented by the grid value of two (2). There is a 10% or higher probability of thunderstorms during the valid period.

3. A slight (SLGT) risk, represented by the grid value of four (4). This is an area where organized severe thunderstorms are expected, but in small numbers and/or low areal coverage. Depending on the size of the area, approximately 5 to 25 reports of ¾ inch or larger hail, and/or 5 to 25 reports of 50 knot sustained wind speeds, and/or 1 to 5 tornadoes would be possible.

4. A moderate (MDT) risk, represented by the grid value of six (6). This is an area with a potential for a greater concentration of severe thunderstorms than the slight risk, and in most situations, greater intensity and areal coverage of severe weather.

5. A high (HIGH) risk represented by the grid value of eight (8). This is an area where a major severe weather outbreak is expected, with a high concentration of severe weather reports and an enhanced likelihood of extreme severe events (i.e., violent tornadoes or very damaging convective wind events occurring across a large area). In a high risk area, the potential exists for 20 or more tornadoes, some possibly EF2 or stronger, or an extreme derecho (for information on derechos, see http://www.spc.noaa.gov/misc/AbtDerechos/derechofacts.htm) potentially causing widespread wind damage and high wind gusts (70 kts or more) that may result in structural damage.

The slight, moderate, and high categories are used when organized convection with tornadoes, and/or large hail, and/or damaging winds are expected. Examples of organized convection include supercells (see http://www.spc.noaa.gov/faq/tornado/suprcell.htm), squall lines (a solid or broken line of thunderstorms or squalls that may extend across several hundred miles), and multi-cell thunderstorm complexes. Pulse type thunderstorms, consisting primarily of solitary brief severe updrafts (often found in weakly sheared environments) are not considered organized. Isolated severe storms with marginal intensities or short durations of severe will likely not be included in a risk area.

Note: A 5% probability for only a tornado threat (mainly associated with tropical systems) can be issued as a SLGT RISK.

Probability Outlooks

An in depth discussion of probabilities and their meaning is available at http://www.spc.noaa.gov/products/outlook/probinfo.html.

Even without a complete understanding of what the probabilities mean, users can directly assess from the data:

- Geographic areas where the various severe weather hazards are expected. These areas may or may not overlap with one another.
- The perceived levels of threat for the severe weather hazards. The higher the probabilities are, the increased threat of that hazard occurring. Refer to the discussion above concerning the probabilities used in the outlooks and especially the range of probabilities used.
- Areas where extreme severe weather is expected.

b. Product Availability:

- Day 1 Categorical Outlook, Hail Probability, Damaging Thunderstorm Wind Probability, Tornado Probability, Extreme Hail Probability, Extreme Damaging Wind Probability, and Extreme Tornado Probability Products are produced by SPC at 0600 UTC, 1300 UTC, 1630 UTC, 2000 UTC, and 0100 UTC. See NOTE below for more information.

- Day 2 Categorical Outlook and Day 2 Severe Thunderstorm Probability and Extreme Severe Thunderstorm Probability are produced by SPC at 0700 UTC (0600 UTC during Daylight Savings Time) and 1730 UTC. See NOTE Below for more information.

- Day 3 Categorical Outlook and Day 3 Severe Thunderstorm Probability and Extreme Severe Thunderstorm Probability are produced by SPC at 0830 UTC (0730 UTC during Daylight Savings Time). See NOTE Below for more information.

NOTE: Files received at the NDFD Central Server by 45 minutes past the hour will be updated in NDFD near the top of the following hour. Files received after H+45 will be updated in NDFD one hour later. This is the same update methodology used for all NDFD elements covering Days 1 to 3.

c. Additional Information:

Detailed descriptions of these products are available on the SPC web site. See:

http://www.spc.noaa.gov/products/outlook/probinfo.html

For more information on the NDFD, please refer to the NDFD web site at:

http://www.nws.noaa.gov/ndfd/index.htm

Experimental NDFD elements in GRIB2 format are differentiated from operational elements by their file access (subdirectory) locations. Experimental NDFD elements in graphic format are identified with an "experimental" label on the graphic; graphics generated by NWS from operational NDFD elements do not include this label. There is no distinction in NDFD XML between experimental and operational elements.

At the close of the comment period (June 29, 2007), these experimental elements will be evaluated using objective (e.g., statistical and technical aspects) and subjective (e.g., internal and external feedback) criteria to determine if the elements are ready to be upgraded to operational status.